Beliefs and Trust

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BELIEFS AND TRUST: AN EXPERIMENT

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Beliefs and trust: an experiment*

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Abstract

In this paper, we address the concept of trust by combining (i) the self-reported trust and belief in trustworthiness of others from a general unpaid questionnaire, (ii) choices made in a social valuation task designed to measure subjects' distributional preferences, (iii) strategies submitted in the trust game in both roles of the game, and (iv) subjects' beliefs about the strategies of their co-player submitted in the form of probability distributions and incentivized by the quadratic scoring rule. We show that trust can be expressed as a belief in positive reciprocity of the trustee, and answers to general questionnaire lack predictive power. Distributional preferences also play a role in the decision to trust in that they affect the subjects' beliefs about the positive reciprocity of others. Cooperative subjects are more optimistic in their beliefs and therefore trust more.

JEL Classification: C72; C91

Key words: Experimental economics; Trust; Beliefs; Distributional preferences

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1 Introduction

Trust is often defined operationally as an expression of the trustor's belief in the positive reciprocity of the trustee. In this paper, we combine several sources of information in order to obtain insight into trust: (i) the self-reported trust and belief in trustworthiness of others from a general unpaid questionnaire, (ii) choices made in a social valuation task designed to measure subjects' distributional preferences, (iii) strategies submitted in the trust game in both roles of the game, and (iv) subjects' beliefs about the strategies of the anonymous other subject they were matched with, submitted in the form of probability distributions and incentivized by the quadratic scoring rule. By this unique mix of information, we address the question whether trust can be expressed as a belief in return, and simultaneously, what role the subjects' distributional preferences play in the act of trusting another subject. Additionally, predictive power of general unpaid questionnaires can be assessed by relating them to subjects' actual behavior and beliefs reported under incentives guaranteeing their careful formulation.

In the original design of the trust game, introduced by Berg, Dickhaut and McCabe [3], two players are asked to choose an action in sequence. The first mover has to decide how much of his/her endowment he/she wants to give up and *transfer* to the second mover. The money thus received by the second mover is then multiplied by three, and the second mover has to choose how much of this amount he/she wants to give up and *return* to the first mover. This game captures the basic elements of a situation in which trust could play a role: the first mover can choose an action which would give the second mover a possibility to repay the resulting economic gain, however, as such reciprocal action cannot be enforced, the first mover faces the risk of being left out from the profits. He has to have trust in the second mover, otherwise, no transaction takes place. In the only subgame perfect Nash equilibrium of the trust game, a money maximizing second mover will never return a strictly positive amount of money, and hence the first mover will never transfer any positive amount of money. This is not observed in the experiments. The first movers transfer on average half of their endowment to the second movers, who often return at least some of the generated profit to the first movers.

The design of the experiment reported in this paper deviates from this typical design in some aspects. We use strategy method experiment where the trust game is played behind the veil of ignorance, i.e. before the roles are assigned to the players. All experiment participants were asked to submit their action as the first mover in the trust game, and afterwards a complete strategy for the second mover. Only then, they were randomly assigned their role in the game (i.e. with probability 0.5 the role of the first mover and with probability 0.5 the role of the second mover), and their payoffs were determined according to the strategies submitted in the assigned role[1]. In order to simplify the task of submitting probability distributions reflecting subjects' beliefs, we present subjects in our experiment with a simplified version of the trust game where the strategy set of the

[1] The first to apply a very similar method for the trust game previously were by Burks et al.[6], followed by Chaudhuri and Gangadharan [9]. Subjects in these experiments submit a strategy in the role of the first mover and then also in the role of the second mover. They are, however, paid for both their roles which might allow for strategic hedging in the trust, and play the game in each of the roles to another randomly selected subject in the session.

first mover (referred to as Sender 1) consists of integers between 0 and 3, and the actions available to the second mover (referred to as Sender 2) are expressed in relative terms as a share of the received amount to return; a subject can decide to return either nothing, one third, one half, two third, or all of the received amount. We discuss the possible implications of our design as opposed to the typical trust game design in the following section.

The main question we address is the motivation for money transfer in the trust game, i.e. whether subjects' beliefs rationalize their trusting behavior via expecting monetary return and what is the role of pure distributional preferences in the decision to trust a stranger. As formulated by Cox [10] (p.263) *"Does the first mover do this because she trusts that the second mover will not defect? Or would she do it anyway because she has other-regarding preferences in which the pair of payoffs created by her action is preferred to the pair of payoffs determined by the two player's endowments?"* Evidence in the literature is divided, and there can be support found for both viewpoints. On one hand, Cox [11] shows that distributional preferences might be responsible for most of the transfers made in the trust game by comparing the transfers in this game to the transfers made in the dictator game, where no expectation of return is present. Subjects do not transfer significantly more in the trust game, stirring doubts whether there is any trust (in the form of expectations of return) present at all in the trust game. There is also contradictory evidence available: McCabe et al. [21] collect data on a simplified trust game where subjects behave in accordance with expectations of positive reciprocity, and Gneeze et al. [18] find that trustor's amount invested into the trustee increases with the trustee's ability to reciprocate, suggesting that it is indeed the belief in reciprocation that motivates at least partially subjects' behavior.

A possible mechanism why some subjects transfer similar amounts in the trust game and in the dictator game is found in the study by Bohnet and Zeckhauser [5]. Although Eckel and Wilson [15] find no correlation between risk aversion measures (involving randomization by a "machine") and the behavior in the trust game, Bohnet and Zeckhauser [5] provide evidence that subjects show different attitudes to lotteries where the randomization is done by machine, and when the bet is on a choice taken by a human. In particular, subjects require higher compensation for their willingness to choose the lottery over a safe payoff in the second case than in the first case. If this is the case, then moving from the dictator game to trust game, a subject is not only exposed to the possibility of a return by reciprocity activated by his trust, at the same time he is also exposed to the aversion towards bad outcomes in the lottery on the population of possible co-players. Taken together, these two effects (increase of transfers due to trust in return and decrease of transfers due to betrayal aversion) may cancel each other out.

The advantage of our design is that it provides subjects with financial incentives to report their beliefs about the strategies submitted by their co-players truthfully, incentivizing their careful formulation and reducing the noise. Our conclusions using this data refute the suggestion that trustors' behavior is independent of their beliefs. We find that 43/58 (74%) of the trustors believe in positive return from the trusting action and 43% of all trustors actually choose the action which they believe will maximize their monetary return. The consistency between beliefs and actions is thereby highest for the most risky - and most trusting - action, where three quarters of all players choosing this action also

expect that this is the action that maximizes their payoffs. While the predictive power of the submitted beliefs is high, the general unpaid questionnaire data does not predict behavior nor beliefs of the subjects. Finally, the role of distributional preferences in the trust game is subtle. Subjects with a higher propensity to care positively about the payoff of another anonymous co-player are those who hold more optimistic beliefs with respect to the positive reciprocity of others. Hence, they trust more often. This links the beliefs held by a subject and his/her decision to place trust in an anonymous co-player to the distributional preferences expressed by this subject.

The remainder of the paper is organized as follows: experiment design is outlined in Section 2, and data analysis can be found in Section 3. Section 4 concludes.

2 Experiment design

We present here data from three experimental sessions conducted at University of Liverpool, Management School, in the academic year 2005. The subjects were 58 students of various business, economics and finance programs (34 males and 22 females, average age 22 years), who participated in cca 1,5 hour lasting experimental session. The language of the experiment was English, and it was computerized, programmed and conducted using z-Tree (Fischbacher [16]). Upon arrival at a session, participants were randomly seated at computers. No communication other than via computer was allowed. Subjects were paid for their decisions in the experiment and they earned on average 6.8 pounds.

Before the start of the experiment, subjects provided answers to a non-paid questionnaire containing six questions from the General Social Survey on trust and fairness (see Appendix 1). After being welcomed to the experiment, we informed them that they will participate in three independent paid tasks. The instructions to each task were distributed only before the start of the task (see Appendix 2), and the feedback on the decision of others in each of the tasks was provided only at the end of the experiment. A social valuation tool measuring subjects' distributional preferences was administered as Task 1[2]. One-shot trust game was administered as Task 2. Finally in Task 3, subjects were given material incentives in the form of the quadratic scoring rule in order to state their beliefs about the complete strategy chosen by the subject matched to in Task 2. Let us describe each of the tasks in some more detail.

Task 1: Social valuation

The first task adapts the decomposed game technique developed by sociologists to measure subject's distributional preferences (see e.g. Messick et al. [22]). Its advantage over a dictator game is that a subject makes multiple decisions, diminishing the impact of noise. In particular, the task consists of 24 choices between two payoff vectors (Option A and Option B) representing monetary payoff consequences for the deciding subject and one other experiment participant, see Table 9 in Appendix 2. The payoff vectors are generated by points spaced equidistantly on the perimeter of a circle. x-axis coordinate represents the payoff to the deciding subject, and y-axis coordinate the payoff to one another subject. Each neighboring pair of payoff vectors is presented to a subject as one

[2]The authors are thankful to Theo Offerman, Joep Sonnemans, and Arthur Schram whose instructions for the social valuation task they adapted.

decision situation. We randomized the order of decision situations before the experiment and then presented all subjects with the same order of the payoff vector pairs. A subject was assigned randomly and anonymously to the same other subject for all 24 situations.

Subject's earnings in this task was the sum of points allocated to the subject from the payoff vectors chosen by the subject himself, plus the sum of points from the payoff vectors allocated to the subject by the other anonymously matched subject. Before the start of this task, we presented the subjects with one of the 24 situations, gave them hypothetical choices for two subjects in this situation, and asked them to calculate the implied payoffs for the two subjects. The experiment did not continue until everybody provided correct answer to this test question.

Task 2: Trust game

The second task in the experiment was a trust game played by a strategy method behind the veil of ignorance. According to this method, all subjects were asked to submit first the strategy as Sender 1 and then the full strategy as Sender 2. Subjects were informed that they are matched into pairs by the computer to another subject than in Task 1, and that the computer will randomly assign them to the roles in the trust game at the end of the experiment. Each subject was paid only for the strategy submitted in the role assigned by the computer, but this role was not known to them at the moment of the decision-making.

In order to make the task that followed this trust game (the task of submitting beliefs) tractable for the subjects, we implemented a simplified version of the trust game in our experiment. Sender 1 was endowed with 3 points, and could choose to transfer to Sender 2 any integer amount. So, the strategy set of Sender 1 was $M_1 = \{0, 1, 2, 3\}$, instead of the usual set of integers between 0 and 10. Sender 2 (who also received an endowment of 3 points) obtained three times the amount $m_1 \in M_1$ chosen by Sender 1, and could choose to return back one of the following fractions of the received amount: nothing, one third, one half, two third or all of the received amount. So, the strategy set of Sender 2 was $M_2 = \{0, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, 1\} \times \{0, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, 1\} \times \{0, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, 1\}$. In this way, the number of actions available to Sender 2 was independent of how many points Sender 1 chose to transfer. We asked the subjects to submit the whole strategy for Sender 2, i.e. the chosen fraction in case Sender 1 sends 1 point, 2 points and 3 points, and quoted with each of the available actions also the resulting final payoffs for both players.

Before the start of this task, subjects were again presented with hypothetical scenario of strategies submitted by two subjects, and had to calculate the implied payoffs for both Sender 1 and Sender 2. An answer to this question was, upon submitting answers by the subjects, discussed also publicly in the sense that the payoff function for Sender 1 and Sender 2 was again quoted from the instructions. This implied taking extensive care in familiarizing the subjects with the payoff consequences of their possible actions in the trust game.

The trust game played in this experiment differs in some aspects from the typical trust game as introduced by Berg, Dickhaut and McCabe [3]: (1) each subjects submits strategies for both roles before learning the one role he/she will be paid for; (2) the strategy set of both players is reduced; (3) Sender 2 players are presented not only with the strategies available to them, but also with the final payoff consequences of each action for both players. Let us comment on these changes in a sequence. (1) There is some evidence

in the literature on how strategy method affects subjects as oppose to their behavior in the same game[3], but the effect does not seem to be strong. On the other hand, previous studies show that stimulating players to think about both roles in a two-player game might alter their behavior in comparison to the typical one role design[4]. In all studies we are aware of, though, the shift is unidirectional, in the direction of money maximization and narrow self-interest, yielding behavior closer to the Nash equilibrium predictions. Any behavior deviating from the predictions of SPNE for pure money-maximization that survives the prompting for strategic reasoning is therefore likely to be an outcome of strategic reasoning by subjects with preferences differing from self-centered own-payoff-maximization. (2) Vyrastekova and Onderstal [30] find that in the trust game played behind the veil of ignorance - but with the usual strategy set for the first and second mover - subjects submit strategies which are very similar to the typical one-role trust game. They also find that the distribution of the actions peaks at the extreme points in the strategy set (transfer all and transfer nothing of the endowment) and in the middle of the strategy set: women choose most frequently the moderate midway, while men's choices are located most frequently on the two edges of the spectrum. Our experiment was mixed in gender (more than one third of participants were women) so that the absence of equal split in the Sender 1's strategy set might distort the observed distribution of Sender 1's strategies as compared to a design where equal split would be available, by overrepresenting the near-equal splits. This seems not to be the case in our dataset, as we discuss in the next section. (3) As for presenting Sender 2 players with final payoff consequences of her available actions, we only remark that it is always the intention of an experimentalist to present to a subject enough information to be able to make an informed decision. As we focus in this study on the correlation between subjects' beliefs and their play, we found it important to make the payoff structure of the game as transparent as possible. Presenting the final payoff consequences instead of only the strategies of Sender 2, however, might shift the salience of the strategies available to Sender 2 towards equal split outcomes. Let us therefore underline that it is the focus of this study to relate players beliefs to their actions in the trust game, in particular under the circumstances when the final payoff consequences for the players are very transparent.

Task 3: Beliefs

Finally, in the third and last task of the experiment, we asked the subjects to submit their beliefs about the actions in the trust game taken by the subject they were matched

[3]Brandts and Charness [7] compare "hot" and "cold" experiments, finding no difference between the actions and submitted strategies. Similarly, Offerman et al. [23] compare strategies and actions submitted by the same subjects in an overlapping generations experiment and find that more than 90% of the actions to be consistent with the full strategies their submitted; and Sonnemans [28] reports high degree of consistency between submitted strategies and action decisions in a search experiment.

[4] Burks et al. [6] explore the effect of playing the trust game with role reversal. Subjects exposed once to role of first mover and once to role of second mover in the trust game show less trust and reciprocity, meaning that both transferred and returned amounts are lower with trust reversal than in the standard one-shot trust game. However, subjects are paid for both roles in their experiment, what might lead subjects to less weight put on the earnings from trust and reciprocity. Croson [12] shows that eliciting beliefs about behavior of others in simple games leads to a behavior closer to the one predicted by Nash equilibrium compared to when beliefs are not elicited. Schotter et al. [26] point out that presentation (in normal form or extensive form) matters as well, most strikingly in simple games.

to in Task 2. Recall that the matching was random and anonymous and that the subjects received no feedback on the choices of the person they were matched with during the experiment. In order to obtain truthful reports, we paid the subjects using a quadratic scoring rule.[5] Each subject was asked to submit a probability distribution over the feasible four actions of Sender 1, and three probability distributions, conditional on action by Sender 1, representing their beliefs of the actions submitted by Sender 2. Subjects were paid separately for the correctness of each of the guesses by the quadratic scoring rule (see Appendix 2 for the formula).

3 Data analysis

In this section we first make a comment on the predictive power of the general unpaid questionnaire on trust and trustworthiness of others for the behavior in the trust game. Then we present the observed strategies and beliefs submitted in the trust game, and discuss subjects' distributional preferences revealed in the social valuation task. Finally, we proceed to merge this information to analyze to what extent beliefs and distributional preferences as well as self-reported trust and trustworthiness of others explain actual behavior in the trust game.

3.1 Predictive power of the general questionnaire

Unpaid questionnaires represent a fast source of information on the respondents' preferences and attitudes, but their predictive power for actual behavior in situations they address is questionable. This might relate to the formulation of the questions (i.e. to what extent they capture in the minds of respondents the decision situation they should describe), but also to the fact that the answers are "cheap" while the behavior they should describe has real consequences for the respondents. We present in our study the subject pool with six questions from the General Social Survey[6], see Appendix 1, to categorize them on the trust and their belief in trustworthiness of others[7]. If questionnaire data correlates with the subjects' behavior and beliefs, we expect that: (i) Subjects who report to trust others transfer as Sender 1 more than subjects who report to distrust others. (ii) Subjects who report that others are trustworthy transfer as Sender 1 more than subjects who report that others are not trustworthy. (iii) Subjects who report to trust others expect a higher return from Sender 2 in the trust game than subjects who report to distrust others.

[5] Sonnemans and Offerman [29] conclude that subjects make efforts when formulating their beliefs and paid by the quadratic scoring rule, and Huck and Weizsacker [19] find this procedure to be superior to the bidding mechanism.

[6] GSS is conducted by by the National Opinion Research Center at the University of Chicago and collects information on a wide variety of topics, including attitudes toward social issues, religion, education, jobs and the economy, government and other institutions, politics, and policy issues.

[7] Subjects are categorized as trusting if they submit answer (a) to question 4 and answer (a) or (b) to question 5. They are not categorized otherwise. Similarly, subjects are categorized as believing that others are trustworthy if more than half of their valid answers (i.e. answers other than the blank answer "I do not know") indicate the following answers: (a) to question 1, (c) or (d) to question 2, (a) to question 3, and (b) to question 6.

Category (based on questionnaires)	
Others are not trustworthy & I distrust them	11/58 (19%)
Others are not trustworthy & I trust them	6/58 (10%)
Others are trustworthy & I distrust them	1/58 (2%)
Others are trustworthy & I trust them	23/58 (40%)
Not categorized	17/58 (29%)

Table 1: Subject pool categorized based on questionnaire answers.

Using the measures of reported own trust and trustworthiness of others, we can categorize somewhat less than three quarters of the subject pool (41/58, 71%), see Table 1. Most of these subjects say they trust others (29/41, 71%), and this attitude is prevalently justified by their belief that others in the population around them are trustworthy (holds for 23/29, i.e. 80% of the trusting subjects). Additionally, in accordance with logic, nearly all of the categorized subjects who report to distrust others believe that others are not trustworthy (i.e. out of the categorized distrusting individuals 12/41, 29% , this holds for 11/12, 92%). It seems therefore that subjects' categorization based on their questionnaire answers leads to a reasonable population description.

However, the explanatory power of the questionnaire for the behavior in the trust game is very weak. Subjects categorized as trusting transfer on average the same as those categorized as not trusting, and these two subgroups believe to obtain on average the same return for their money transferred as Sender 1. And, those who are categorized to believe that others are trustworthy do not transfer more than the remaining subjects. These conclusions are based on the non-parametric Mann-Whitney U tests using the relevant variables. The only effect we find is based on the "trust question" in isolation: subjects who say that "Most people can be trusted" transfer on average 2.4 (N=15), and subjects who say that "You can't be too careful in dealing with people" transfer on average 1.9 (N=40). The difference is significant (p=0.03, 1-sided Mann-Whitney U test). But, these subjects expect (on average) to get the same return (p=0.350, 1-sided Mann-Whitney U test). In the literature, a similar weak link is found, though the "trust question" usually picks up trustworthiness of the subject in behavior rather than trusting behavior (see Glaeser et al. [17] and Ashraf et al. [1]).

3.2 Strategies and beliefs in the trust game

In the trust game, **Sender 1** transfers on average 65% of the endowment (1.95 points) to Sender 2, for distribution see Table 2. 10% of Sender 1 players transfer nothing as a money-maximizing individual in the population of money-maximizers would choose, but most frequent is the decision to transfer the whole endowment, chosen by 41% of all subjects.

When compared to previous studies[8], these average transfers fall within the range observed in the typical one-role no-strategy-method design as introduced by Berg et al.

[8]See Berg et al. [3], Ashraf et al. [1], Bellemare and Kroeger [4], Burks et al. [6], Bruelhart and Usunier [8], Chaudhuri and Gangadharan [9], Cox [10] and [11], Danielson and Holm [13], Ortman et al. [25].

Points transferred	N
0	6/58 (10%)
1	12/58 (21%)
2	16/58 (28%)
3	24/58 (41%)

Table 2: Sender 1 strategies in the trust game.

Return strategy monotonicity	N
Decreasing	5/58 (9%)
Constant	36/58 (62%)
Increasing	11/58 (19%)
Not monotonous	6/58 (10%)

Average return	N
0	9/58 (16%)
(0,0.33]	6/58 (11%)
(0.33,0.5]	14/58 (24%)
(0.5,0.67]	28/58 (48%)
(0.67,1]	1/58 (2%)

Table 3: Sender 2 strategies in the trust game.

[3] (see also the replication by Burks et al. [6]). The two-role treatment with prior knowledge by Burks et al. [6] which is most similar to our design gave rise to lower average transfers than our experiment.

The behavior of **Sender 2** is summarized in Table 3. Most subjects (22/58, 38%) choose to return two thirds of the received amount to Sender 1, thus equalizing the payoffs between Sender 1 and Sender 2. The average return is 141% of the amount sent by Sender 1. Recall that Sender 2 players were submitting a complete strategy, i.e. fraction to return conditional on receiving 1, 2 or 3 points from Sender 1. Most subjects (36/58, 62%) chose to return the same fraction of the received amount, independent of Sender 1's transfer.

The observed average return is on the higher side among previous experiments, and this despite the fact that we use a strategy method and subjects submit strategy for both roles. This might be due to the fact that subjects deciding on Sender 2 strategy observe on the screen the final payoffs associated with the available actions. As it is, our subjects split the surplus generated by the transfer of Sender 1 most often equally, while in many other studies, the first movers barely make profits (or make losses) on the amount transferred to the second mover. Most remarkably, the two-role-prior-knwowledge treatment by Burks et al. [6] which might be closest to our design leads to strikingly low returns compared to ours. The main difference (safe for the differences in the strategy set and presentation of final payoffs) is that we pay subjects for one role only although subjects provide strategies for both roles. Reduced responsibility for earnings of the other subject under two paid roles in Burks et al. [6] might have contributed to lower cooperation rates compared to our experiment.

Figure 1 summarizes the subject pool composition by strategies submitted in the trust game by a subject in both roles. It shows the fraction of subjects using each of the available return actions (depending on when subject received 1, 2 or 3 points as Sender 2), and each of the transfer actions. Obviously, as Sender 2 players often choose monotonous strategies, there are only minor quantitative differences across the three transfer levels

available to Sender 1 when subjects decide as Sender 2. The most frequent strategy in the experiment (submitted by around one fifth of the population) entails to transfer all 3 points as Sender 1 and return back two thirds of the received points as Sender 2. This strategy results in the efficient and equitable payoff distribution between Sender 1 and Sender 2. Among the subjects who transfer 0 points as Sender 1 (i.e. choose a strategy that could either be interpreted as the strategy of a self-interested individual or a strategy of an individual with little "trust"), we find that most of them can be described as money-maximizers, i.e. they return nothing in the role of Sender 2. However, also some of the subjects transferring all 3 points choose to return 0 points, suggesting that their transfer was not motivated by the desire to share payoffs but by strategic considerations.

Observation 1: On average, Sender 1 passes around two thirds of her endowment to Sender 2. This decision to trust is profitable as on average, 141% of the transfer is returned back by Sender 2. The most frequent strategy combination chosen by one fifth of all subjects results in the efficient and equitable payoff outcome of the trust game.

Let us now discuss the beliefs that subjects submitted about the strategies of their anonymous co-player. These beliefs show several regularities allowing us to conclude that subjects paid attention to their formulation. For example, less than one fifth of all subjects place all weight on one of the available actions in the four probability distributions they had to submit, while the remainder spread the probability weight over two or more actions. Also, only 2 out of the 232 totally submitted probability distributions are uniform, i.e. "uninformed". Most subjects also believe that others are similar to them: they assign the highest weight in the probability distribution to the action they chose themselves (76% for Sender 1 strategy, and 66%, 64%, and 72% for Sender 2 strategy in case Sender 1 transferred 1, 2, or 3 points respectively).

Can we rationalize the decision to transfer money by the subjects' beliefs? Most subjects (43/52, 83%) who transfer money in the trust game believe that they will not make a loss, see Table 4. Indeed, Spearman's correlation coefficient between the amount transferred and the average believed return is positive and significant, 0.259 (p=0.050). One would expect that the more a subject believes to receive back, the more he/she will transfer in the trust game. This is supported by Joncheere-Terpstra test (p=0.048), see Table 4. Subjects who transferred 0 points in the role of Sender 1 believed to receive back the smallest fraction of their transfer (and less than the one third necessary so that their transfer is not unprofitable). In pairwise tests, it stands out that it is indeed the subjects who transferred 0 points as Sender 1 who believed in smallest returns in comparison to subjects choosing strictly positive transfers; the remaining pairwise tests do not uncover significant differences. So, the decision to transfer or not to transfer points as Sender 1 can be rationalized by the belief in return from Sender 2 which is well justified in the light of actual returns. Stimulating subjects to think about both roles in the trust game did not lead to very low transfers.

We further investigate whether subjects' transfers are rational in the sense of maximizing their expected payoff given the submitted beliefs, see Table 5. We find that subjects choosing intermediate transfers of 1 and 2 points are those who are the least consistent

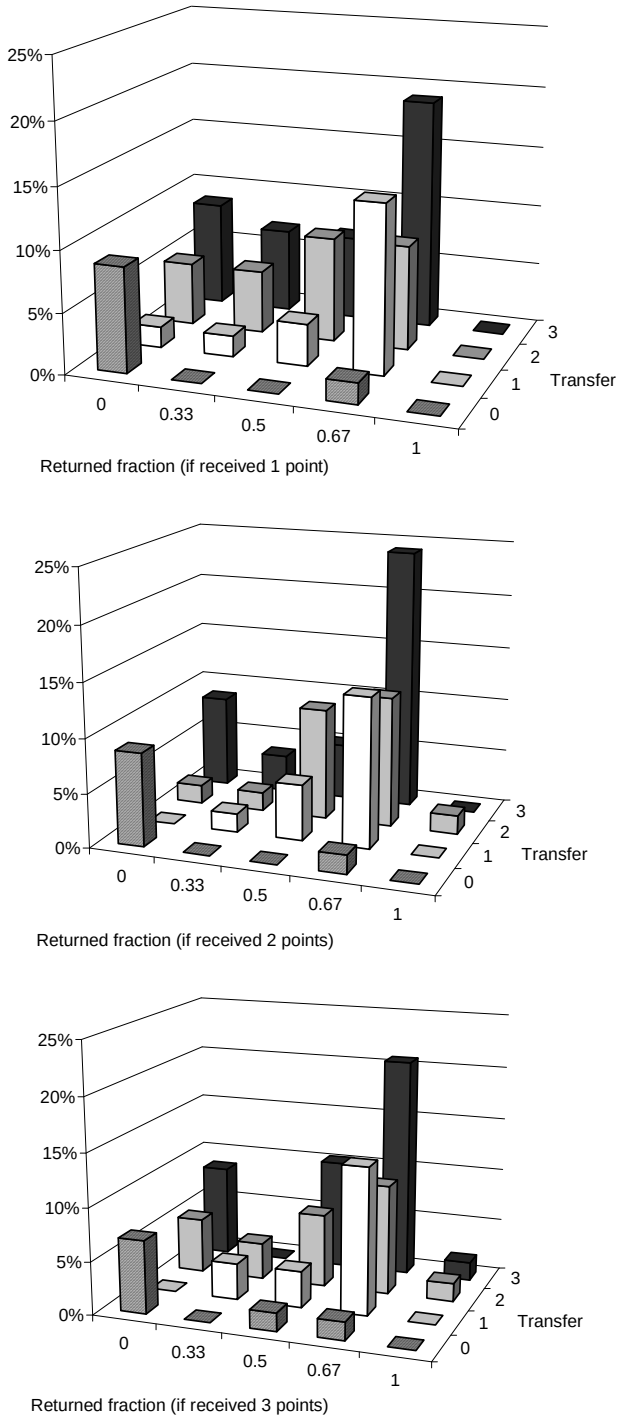

Figure 1: Subject pool composition by strategies submitted in the trust game. Return strategy when subject received 1 point as Sender 2 (above), 2 points as Sender 2 (middle) and 3 points as Sender 2 (below).

Transfer	N	Average believed return	Average believed return<0.33	Average believed return≥0.33
0	6	0.266	4/6 (67%)	2/6 (33%)
1	12	0.474	1/12 (8%)	11/12 (92%)
2	16	0.427	3/16 (19%)	13/16 (81%)
3	24	0.466	5/24 (21%)	19/24 (79%)

Table 4: Average believed return vs. chosen transfer by Sender 1.

Actual	Believed that payoff is maximized for transfer				Believed maximizer
transfer	0 points	1 point	2 points	3 points	is chosen
0 points	3	2	0	1	3/6 (50%)
1 point	1	0	2	9	0/12 (0%)
2 points	0	1	4	11	4/16 (25%)
3 points	4	0	2	18	18/24 (75%)

Table 5: Expected payoff maximizing vs. chosen transfer by Sender 1.

with their reported beliefs. On the other hand, subjects choosing the most risky "trusting" action are those who are most often believing that this action will maximize their average believed earnings in the experiment. Whatever the motivations for holding such beliefs are (expectations of reciprocity or some form of other-regarding preferences by the other subject), the highest transfers can be justified by the beliefs in material payoffs of such an action. Overall, 25/58 (43%) of all subjects choose transfer that is consistent with expected payoff maximization. Focusing on the transfers of 1 and 2 points, where subjects might deviate from the payoff maximizing transfer both directions, we see that 22/28 (79%) of these subjects transfer less than the expected payoff maximization would predict, suggesting that risk aversion might play a role[9]. Only 2/28 (7%) of them sent more.

Observation 2: Transfers in the trust game can be rationalized by the Sender 1's belief in return from Sender 2. The amount sent in the Trust game as Sender 1 by a subject is positively correlated with that subject's average believed return by Sender 2. The decision to transfer 0 points is accompanied by the belief that transferring strictly positive amount would yield a loss.

We are not aware of another study that uses an incentive compatible mechanism for collecting information on subjects' beliefs in the trust game. Several authors, however, accompanied their trust game experiments by unpaid questionnaires addressing subjects' expectations of return from the money transferred in the trust game. Mostly, these studies arrived at conclusions similar to ours. For example, Ortman et al. [25] ask subjects in one of their treatments (before they play the game) how much their expect in return and conclude that differences in behavior across sessions are clearly driven by these beliefs. Chaudhuri and Gangadharan ([9]) ask the question about expected return after Sender

[9]Schechter [27] provides evidence from a field experiment that risk preferences indeed matter in trust game.

Distributional types	N=58	Avg.transfer	Avg.return	Avg.believed return
Competitive [-67.5; -22.5)	9 (16%)	1.33	0.31	0.36
Individualistic [-22.5; +22.5]	39 (67%)	1.95	0.46	0.43
Cooperative (22.5; 67.5]	9 (16%)	2.78	0.66	0.55
Altruistic (above 67.5)	1 (1%)	3.00	0.50	0.52

Table 6: Distributional types in the subject pool based on the social valuation task.

1 submitted transfer decision but before he/she learned the actual return, and observe significant positive correlation between these two variables. Bruelhart and Usunier [8] collected information on expected returns from Sender 1 players in an ex-post experimental questionnaire and also conclude that these beliefs (although noisy) explain decisions taken in the trust game. Contrary to this, Ashraf et al. [1] find that 38% of trusting subjects expect to make a loss on the amount transferred to the second mover - however, we have to remark that these subjects played the trust game in a design where only the first mover received a positive endowment, possibly strengthening the distributional motives for transfers. In any case, the more optimistic is the subjects' reported belief in terms of expected return, the higher is the average transfer the subject makes, evidencing the role of the reported expectations. Connecting trust and trustworthiness by a different method, Barr [2] shows that the level of trust in experiments run among members of closely knit village communities in Zimbabwe can be explained by the average level of trustworthiness measured in the community by the second movers' actions in the trust game. Overall, the evidence found in the literature is consistent with the findings presented here: subjects' expectations affect the extent of trust reflected in their actions.

3.3 The role of distributional preferences

The measure of distributional preferences in our experiment is the angle of the final payoff vector obtained as a sum of all chosen vectors by the subject in the social valuation task (referred to as "distributional angle"). Sociologists categorize subjects with distributional angle below -22.5 degrees as competitive, above 22.5 degrees as cooperative (and above 67.5 degrees as altruists). Subjects with values in the interval [-22.5; +22.5] degrees are considered individualistic. In our experiment, two thirds of the subjects show individualistic preferences, the remainder is willing to bear costs in order to decrease or increase the payoff of the other subject, showing competitive and cooperative preferences respectively, see Table 6.[10]

Let us first concentrate on Sender 2's strategies. Do Sender 2 players positively reciprocate, i.e. is there a "premium" on returns made in the trust game over what a subject would want to share anyway due to own distributional preferences? For one, we find that the distributional angle is positively correlated with the average return strategy in the trust game (Spearman correlation coefficient 0.352, p=0.002). Not surprisingly, subjects

[10]The average consistency of the choices made by the subjects in our experiment, measured by the lenght of the final payoff vector, is quite high, 86%. Offerman et al. [24] report the respective percentages of cooperative, individualistic and competitive subjects in their pool to be 27%, 65% and 4%.

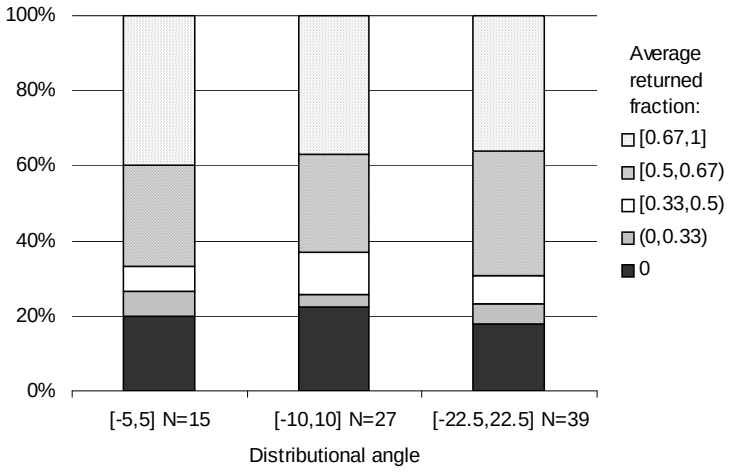

Figure 2: Average returned fraction by individualistic type.

who show more positive concern for the payoff of the other subject in the social valuation task tend to return more than those who are indifferent about earnings of the other, or spiteful towards the other subject, see Table 6. While competitive subjects return on average a fraction that leaves the transfer by Sender 1 unprofitable, individualistic subjects return an amount that makes the investment profitable. Subjects categorized as cooperative share on average the received amount even more and in a way that induces equal payoffs between Sender 1 and Sender 2. Distributional preferences (as expressed by subjects' decisions in the social valuation task) affect the way these subjects choose return strategies in the trust game.

However, more can be said and there is evidence that the return strategy in the trust game is oftentimes motivated by reciprocity. We can detect this for subjects who give up close to nothing in the Social valuation task, but return strictly positive fraction in the trust game, suggesting that they are motivated by reciprocity rather than by distributional motives. In Figure 2 one finds for three definitions of individualistic subjects (based on their final angle coming from interval [-5,5], [-10,10] or –22.5, 22.5]) the average return strategy of these individualistic subjects. Only less than 25% of those who behave in accordance with own payoff maximization in the social valuation task preserve that type of strategy in the trust game by returning less than one third of the received amount in the role of Sender 2. On contrary, three quarters of these subjects expressing (nearly) individualistic preferences in a pure distribution task transfer significant amounts of money back to Sender 1 in the trust game - 40% of them choosing to equalize payoffs between themselves and the trustor. We take this as an important evidence in favor of the reciprocal motives in the trust game.

Observation 3: The decision to return money in the trust game positively correlates with the decision to share money in the social valuation task. Moreover, three quarters of subjects who are categorized as individualistic in the pure distributional

task do return money in the trust game, an evidence of reciprocal motives for sharing in the trust game.

Now we turn to the main question - how the decision to trust depends on the distributional preferences. Again, the distributional angle is positively correlated with the average amount sent by Sender 1 (Spearman correlation coefficient 0.339, p=0.009), see Table 6. The more a subject cares about payoffs of the other subject, the more he transfers in the role of Sender 1.

Can we reconcile this role of distributional preferences with the observation that we made before, i.e. the role of beliefs for trust in the trust game? The answer is hidden in the link between subject's distributional preferences and the beliefs he/she holds. Subject's distributional angle is namely positively correlated with the average believed return by Sender 2 (Spearman correlation coefficient equals 0.399, p=0.002). Cooperative subjects are more likely to believe that others are cooperative - showing therefore more trust, see Table 6: competitive subjects expect on average that Sender 2 players return 36% of what they receive, individualistic subjects expect on average a return of 43%, while cooperative subjects expect a return of 55%.

Observation 4: Subjects' belief that another subject will positively reciprocate in the trust game and subjects' propensity to share payoff in the social valuation task are positively correlated.

The above observation holds a key why we can find support both for the role of distributional preferences as well as for the role of expectations for the decision to trust in the trust game. Psychological theories that link individual's social preferences (distributional preferences) to the beliefs that subject holds about social preferences of others date back to Kelley and Stahelski [20] and rely on the idea that preferences generate self-fulfilling prophecies: competitors, e.g., do not engage in cooperative behavior and hence elicit uncooperative response even from cooperative individuals, while cooperative individuals take risky but jointly beneficial actions, and therefore are also more likely to observe them in others. In this way, subjects holding different social preferences might form differing beliefs with respect to the social preferences of others in the population. The observation presented above gives support for such an interdependence between the subjects' distributional (social) preferences measured in the social valuation task and their expectations with respect to positive reciprocity, i.e. cooperation, of others in the trust game.

3.4 Combining beliefs and distributional preferences in explaining trust

We now proceed to explain the decision to trust in the trust game by combining the pieces of information we collected about the subjects. When using subjects' beliefs and their distributional preferences in one regression, however, we have to take into account that these show interdependency. This problem is exemplified in that each of them separately is significant (at 10% level and better) in the ordered logit regression explaining the decision to transfer 0, 1, 2 or 3 points in the Trust game, see Table 7.

Ordered logit model	Coefficient (Std.error)	
Average fraction believed to be returned	2.723 (1.638)*	
Distributional angle		0.029 (0.011)**
Male	-0.120 (0.515)	-0.313 (0.521)
Question 1 (trustworthiness of others)	-0.544 (0.425)	-0.125 (0.446)
Question 5 (own trust)	0.051 (0.347)	-0.116 (0.357)
N	58	58
Pseudo R^2	0.0302	0.0598
**Significant at 5% level,*significant at 10% level.		

Table 7: Explaining transfer in the trust game.

In order to deal with this colinearity problem, we explain Sender 1's decision to transfer of 0, 1, 2 or 3 points by estimating the following model:

$$x = const + \beta_1 B' + \beta_2 DA + \beta_3 MALE + \beta_4 TRUST + \beta_5 TWORTHINESS + \varepsilon \quad (1)$$

where $x \in \{0, 1, 2, 3)$ is Sender 1's transfer, $B'$is that component of beliefs which cannot be explained by the distributional preferences, DA is the distributional angle, $MALE$ (as a proxy for risk aversion[11]) equals 1 if subject is male and 0 if female, $TRUST$ is answer to question 5 of the general questionnaire as a measure of self-reported trust, and $TWORTHINESS$ is answer to question 1 of the general questionnaire as a measure of others trustworthiness[12]. Here, we have taken into account that subjects' beliefs about the population composition are likely to be affected by their distributional preferences. Variable B' isolates the component of subjects' beliefs not explained by distributional preferences. It is obtained from estimating the following auxiliary OLS model:

$$B = const + \alpha_1 DA + \epsilon \quad (2)$$

where the estimated $\hat{\epsilon}$ is then used to proxy for B' in equation 1. Note here that the subjects were matched in the social valuation task and in the trust game to different co-players, hence it is reasonable to assume that the measured distributional preferences are exogenous vis-à-vis the decision process in the trust game.

The two-stage procedure leads to the estimates presented in Table 8. First, we find no evidence that questionnaire data explains behavior in the trust game. Similarly, the dummy variable for subject being male is not significantly different from zero. Most interestingly, though, we find that the impact subject's beliefs have on the decision to trust in the trust game is captured by the distributional angle. This can be observed from the fact that the coefficient on the average fraction believed to be returned that is

[11] Men are often found to be more prone to take risk than women, possibly leading to gender differences in the decision to trust, see e.g. Eckel and Grossman [14] or Schechter [27].

[12] We estimated all regressions using also the measures of trust and trustworthiness constructed in subsection 3.1. From data on 41/58 thus categorized subjects, we obtain qualitatively the same observations as those discussed here (from all 58 subjects) that are based on questions 1 and 5 of the questionnaire only.

Ordered logit	Coefficient (Std.error)
Average fraction believed to be returned orthogonal to distributional angle (B')	1.317 (1.740)
Distributional angle	0.029 (0.011)**
Male	-0.235 (0.531)
Question 1 (trustworthiness of others)	-0.198 (0.458)
Question 5 (own trust)	-0.088 (0.359)
Pseudo R^2	0.0637
***Significant at 1% level; **significant at 5% level.	

Table 8: Explaining transfer in the trust game - two stage procedure.

orthogonal to the distributional angle does not increase significantly the probability to choose a higher transfer in the trust game. The effect of the distributional angle itself is thereby as expected - the higher weight a subject puts on the payoff of another individual, the more likely he is to make higher transfers in the trust game, after controlling for all other possible explanatory variables. This leads us to the following conclusion:

Observation 5: Subject's decision to place trust in another anonymous subject in the trust game is guided by his belief in return, which in itself is explained by the distributional preferences held by the subject. Subjects who prefer to increase payoffs of others in a pure distributional task although it is costly to them are more likely to believe that others will do the same, and hence they are more likely to trust. Moreover, pure distributional preferences, independent of the subject's belief, also motivate subject's decision to transfer money in the trust game.

4 Conclusions

In this paper, we combine information from unpaid questionnaires, choices made in a social valuation task measuring subjects' distributional preferences, strategies submitted in the trust game for both roles (prior to randomly selecting the one role for which the subject was paid), and subjects' beliefs over the actions of the anonymous other subject they were matched with. In this way, we address the question whether and in which way distributional preferences and subjects' beliefs affect their trust (i.e. belief in the positive reciprocity of an anonymous trustee) and their trustworthiness (i.e. propensity to reciprocate positively the trustor's action). We use within-subjects design and give subjects material incentives in the form of quadratic scoring rule in order to submit beliefs that represent their true beliefs.

We find, consistent with previous literature, that questionnaire data performs poor in explaining behavior in the trust game. On the other hand, there is a strong support for the role of subjects' beliefs in the decision to transfer money. Using nonparametric tests, the expectation of a profit on the transferred money explains most of the transfers made. However, pure distributional preferences measured in the social valuation task also play a role in trusting, as they are correlated with the transfers made in the trust game. Reconciling these pieces of information, we show that the subjects' beliefs are not

independent of his/her distributional preferences. Subjects who spend money in order to share their payoff with another anonymous subject in the social valuation task actually hold more optimistic beliefs with respect to the positive reciprocity of others in the subject pool. In this way, our answer to the question "is trust a belief in positive reciprocity of the trustee or an expression of the trustor's preference for distributing money" reads "both are correct". We conclude that distributional preferences - besides playing a direct role recognized before - do also play an important indirect role, namely via subjects' beliefs. Subjects who are willing to spend money in order to increase material payoffs of others in the pure distributional task are those whose beliefs about the positive reciprocity of others are more optimistic. Therefore, they trust more.

5 Appendix 1: Questionnaire

1. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?

   (a) Most people can be trusted

   (b) You can't be too careful in dealing with people

   (c) I don't know

2. How often do you think that people would try to take advantage of you if they got the chance and how often would they try to be fair?

   (a) People try to take advantage almost all of the time

   (b) People try to take advantage most of the time

   (c) People try to be fair most of the time

   (d) People try to be fair almost all of the time

   (e) I can't choose

3. Would you say that most of the time people try to be helpful, or that they are mostly just looking out for themselves?

   (a) People try to be helpful

   (b) People just look out for themselves

   (c) I don't know

4. Do you think most people can be trusted?

   (a) Yes

   (b) No

   (c) I don't know

5. Do you think of yourself as a trusting person? Are you...

   (a) Very trusting

   (b) Somewhat trusting

   (c) Somewhat distrusting

   (d) Very distrusting

   (e) I don't know

6. Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?

   (a) Most people would take advantage of you

   (b) Most people would try to be fair

   (c) I don't know

7. I am:

   (a) Female

   (b) Male

8. My age is: .....

9. My study major is: .....

6 Appendix 2: Instructions for the participants

The following instructions were read aloud to the subjects for each task separately. See also Table 9 for all 24 decision situations of Task 1.

General instructions

You will now participate in an experiment on economic decision-making. The experiment will last approximately one and a half hours. You will be paid after the experiment. No other participant will learn how much you earned.

You will be paid 1 pound participation fee PLUS any earnings you will make in the experiment. How much you earn crucially depends on your decisions in the experiment. During the experiment, all your earnings are in points. At the end of the experiment, you will be paid real money for the points you earned. The exchange rate is:1 point = 0.5 pound

We'd like to ask you not to talk to other participants during the experiment. Disobeying this rule results in your exclusion from the experiment. If you have any questions during the experiment, just raise your hand and we will come to you to answer them. Note however that we do not answer questions of the type "what shall I do in the experiment?" - it is your own decision. We, however, are happy to answer questions on how to use the computer to make your decisions.

Before we start the experiment, we would like to ask you to give answer to a few questions in the following questionnaire. Your answers have no consequences for your payments in the experiment.

Task 1

The experiment consists of three tasks. You will be paid for all three of them. There is not way in which your decisions in one task affect your payments in another task. The tasks are fully independent. Each time, we first describe the task and ask you to make decisions in it. Only then we describe next task. After these three tasks, you will be paid out anonymously.

TASK 1: In this task, you will face 24 different situations, in which you must make a choice between two options displayed on the screen. Each choice has consequences for your earnings as well as for the earnings of one other participant in this room. You will be randomly assigned to one and the same participant for all 24 situations in this task. Neither of you will learn the other person's identity, not during the experiment, nor afterwards.

For each option in each of the 24 situations, two numbers will be displayed: the number of points you will receive yourself (positive or negative) when you choose this option, and the number of points (positive or negative) the other participant will receive when you choose this option.

Your earnings in this task equal the sum of points allocated to you in the options that you chose, PLUS the sum of points that were allocated to you as a result of the choices made by the other participant. Similarly, the earnings of the other participant in this task equal the sum of points allocated to him/herself in the options that he/she chose, PLUS the sum of points that were allocated to him/her as a result of your choices. The total number of points assigned to you by the other participant is only revealed to you at the end of the experiment (after all three tasks are done).

Have a look at the Table below[13]. It displays one of the 24 situations you will face. If you choose the upper option, 75 points will be deducted from your total, and 130 points will be added to the other participant's total. If you choose the lower option, 39 points will be deducted from your total, and 145 points will be added to the other participant's total.

Note that during the experiment you will not get any information about the choices made by the participant with whom you are paired in this task. Nor will the participant with whom you are paired get any information about your choices. You will receive information about the number of points earned in task 1 only at the end of the experiment. Please, raise your hand if you have questions at this moment. Note that we do not answer questions of the type "what shall I do in the experiment?" – it is your own decision. We are, however, happy to answer any questions about the way your points are calculated, or how the computer program works. If there are no further questions, we will now start by a short test to make sure that everybody understands how points are earned in Task 1.

Task 2

In Task 2, the computer will match you at random to one other participant in this room. This is somebody different than in Task 1. You will not learn the identity of that participant. In this task, one of you will be Sender 1, and the other Sender 2.

You will make first decisions both as Sender 1 and as Sender 2. At the end of the experiment, the computer will randomly decide which of you is Sender 1 and which of you Sender 2. You will be then paid ONLY according to the decisions made in the roles assigned by the computer. Let us explain the decision situation of Sender 1 and Sender 2. First, Sender 1 makes a choice and then Sender 2. Both Sender 1 and Sender 2 receives an initial endowment of 3 points.

SENDER 1 has to choose how many out of the 3 points, he/she will send to Sender 2. Sender 1 can choose any number 0, 1, 2, or 3, see the figure below.

After the decision of Sender 1, SENDER 2 receives 3 times the number of points Sender 1 sent to

[13] All computer screenshots are available from the authors on request.

Situation	Order in	Option A		Option B	
	experiment	Amount self	Amount other	Amount self	Amount other
1	20	+15.0	0.0	+14.5	-3.9
2	17	+14.5	-3.9	+13.0	-7.5
3	12	+13.0	-7.5	+10.6	-10.6
4	22	+10.6	-10.6	+7.5	-13.0
5	16	+7.5	-13.0	+3.9	-14.5
6	5	+3.9	-14.5	0.0	-15.0
7	18	0.0	-15.0	-3.9	-14.5
8	23	-3.9	-14.5	-7.5	-13.0
9	19	-7.5	-13.0	-10.6	-10.6
10	4	-10.6	-10.6	-13.0	-7.5
11	21	-13.0	-7.5	-14.5	-3.9
12	2	-14.5	-3.9	-15.0	0.0
13	7	-15.0	0.0	-14.5	+3.9
14	9	-14.5	+3.9	-13.0	+7.5
15	6	-13.0	+7.5	-10.6	+10.6
16	14	-10.6	+10.6	-7.5	+13.0
17	1	-7.5	+13.0	-3.9	+14.5
18	15	-3.9	+14.5	0.0	+15.0
19	3	0.0	+15.0	+3.9	+14.5
20	13	+3.9	+14.5	+7.5	+13.0
21	11	+7.5	+13.0	+10.6	+10.6
22	8	+10.6	+10.6	+13.0	+7.5
23	10	+13.0	+7.5	+14.5	+3.9
24	24	+14.5	+3.9	+15.0	0.0

Table 9: Social valuation task.

him/her. Now, Sender 2 has to choose what fraction of the received points he/she will send back to Sender 1. Sender 2 can choose to send back nothing, one third, one half, two third or all the points received.

Because the decisions of both Sender 1 and Sender 2 will be announced only at the end of the experiment, Sender 2 has to make the choice what fraction of points to send back for every possible number of points greater than 0 that Sender 1 might send to him/her. See computer screens on the next page.

At the end of the experiment

· if the computer decides that you are SENDER 1, you earn 3 points, MINUS the number of points that you sent to Sender 2 as Sender 1, PLUS the number of points Sender 2 decided to send back to you.

· if the computer decides that you are SENDER 2, you earn 3 points PLUS three times the number of points Sender 1 sent to you MINUS the number of points that you sent back to Sender 1.

The table below (see figure), shows the final number of points to Sender 1 and Sender 2 for every combination of possible choices made by them.

Task 3

In Task 3, we ask you to give us your guess about the choices made in Task 2 by the other participant you were matched to. You will be paid for the precision with which you will make your guesses.

We ask you to give us your estimates of what the participant matched to you did as Sender 1 and as Sender 2. You will be paid for all guesses.

First, we ask you to guess what the other participant did as Sender 1, see the figure below. In particular, we ask you to estimate the probability with which the other participant as Sender 1 sent each of the possible number of points: 0, 1, 2 and 3 points. That means, you have to submit four numbers. Each represents the probability of one of these possible choices of Sender 1. Therefore, these four numbers have to add up to 1, and each of them has to must not be smaller than 0 or larger than 1.

Second, we ask you to estimate what other participant did as Sender 2, see the figure below. In particular, for every possible number of points greater than 0 that Sender 2 might receive (that means for 3, 6 and for 9 points) we ask you to estimate the probability that Sender 2 returned nothing, one third, one half, two third, or everything of the received of points. That means, you make three separate estimates (for the case if Sender 2 receives 3, 6 or 9 points) and in each of them, you have to submit five numbers which represent the probability of each of the possible choices of Sender 2 (send back nothing, one third, one half, two third, everything). These five numbers have to add up to 1, and each of them has to must not be smaller than 0 or larger than 1.

Let us now explain how we will pay you for your guesses. Suppose you make a guess that the other subject as Sender 2 (say, in case he received 6 points) will return nothing with probability A, return one third with probability B, return one half with probability C, return two third with probability D, return everything with probability E. A,B,C,D,E represent numbers between 0 and 1, satisfying A+B+C+D+E= 1. And suppose that in reality, the other subject in the role of Sender 2 made one of these choices, say choice to return everything. Then, we pay you for your guess the following amount of money: 1 point PLUS double your guess for the true choice MINUS the sum of the squared guesses for all the choices. Written as formula, it would read: $1 + 2*E - (A^2+B^2+C^2+D^2+E^2)$

The reason we pay you like this is the following: given this payment rule, it is in your best interest (maximizes the number of points you earn) if you try to guess the probabilities of the choices of the other person as precise as possible. Observe that when your guess places probability 1 on one of the possible choices, and this choice is the true choice, then your earning equals 2 points (i.e. 1 pound). This is maximum you can earn for your guess. Also, when your guess places probability 1 on one of the possible

choices, and this choice is NOT the true choice, then your earning equals 0 points (i.e. 0 pounds). This is maximum you can earn for your guess. We only remind your that you will make altogether four guesses (one for Sender 1 choice and three for Sender 2 choices), therefore the maximum you can earn is 4 pounds and minimum is 0 pounds.

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